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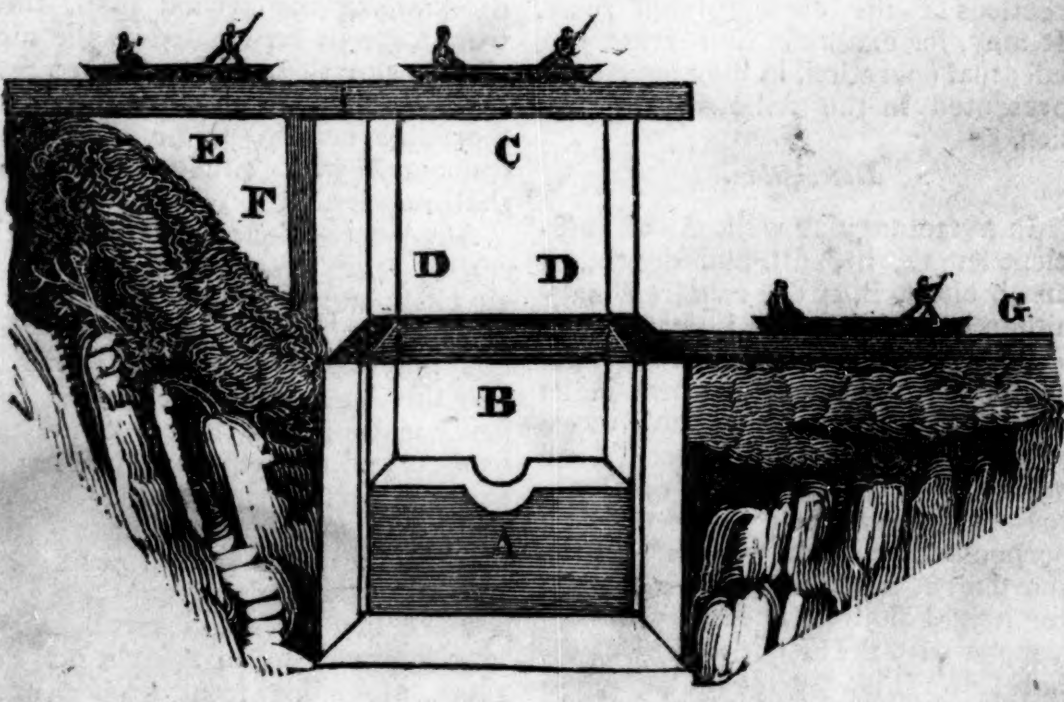
Then let each man observe with care
  The wonders wrought by man's weak hand;
Nor let our scorn the worthless spare;
  Who ne'er such wonders understand.
Of highest genius 'tis the pride
  To comprehend what Art has done,
To know the law her steps that guide,
  And share the glories she has won.

From the German of Schiller.

THE ECONOMICAL HYDROSTATIC LIFT.



Sir,—By giving the following a place in your useful Magazine, you will oblige

A Friend to Useful Improvements.

Baltimore, Sept. 1st, 1825.

THE ECONOMICAL HYDROSTATIC LIFT,

By Wm. Kenworthy, of Baltimore.

A desideratum of superior importance in Inland Navigation; being a very convenient and expeditious operation, so arranged, upon a new plan, that an uninterrupted succession of ascending and descending boats, or other craft, with their cargoes on board, may, with the utmost facility and safety, be floated over any common sum-

mit-level, or incidental impediment in the route, to which only a small portion of water can be constantly brought; very little more than will be required merely to restore the unavoidable waste, daily resulting from evaporation and absorption; in consequence of the same supply being retained, in such a manner that it will always be ready, and may be used over and over again, as often as occasion shall require.

The plan here proposed is considered as being susceptible of a very general and advantageous application, comprehending all the practicable varieties of purposes and situations incident to inland navigation of every description, wherever the object shall be to introduce, improve or extend any water communication, by means of interposing one or more Lifts, between two or more levels or sections of the contemplated route. It may, for example, be carried into effectual operation, in the manner represented in the folllowing description.

Description.

In a rectangular well, A, of sufficient length, breadth and depth, let an air chest, B, of the required magnitude be so immersed in water as to be near the bottom when it is lowest and under the surface when in its highest situation. By suitable posts or pillars, DD, of iron or wood, let a moveable section of canal or water route, C, be securely supported in a perpendicular situation over the above mentioned air chest, at whatever height shall be necessary, to correspond with the height of the intended Lift. This moveable section is to be constructed of wood; open at both ends; but as near each end as will be convenient in practice, a gate is to be closely fitted, to be made in such form or manner, and of such material or materials, as upon trial shall be found to be the most effectual in preventing leakage, and in promoting their being opened and shut with the greatest facility.

Let both the lower extremity of the upper level E, supported by pillars as at F, and the upper extremity of the lower level, G, at the place of the proposed Lift, be made to terminate in a trunk of wood; let each extremity be furnished, also with a gate similar to the gates in the ends of the moveable section; and let the respective ends of the section and trunks be constructed of the same size, and so fitted and adjusted that whenever they shall be brought into contact and forced together by means of clamps or otherwise, little or no water will be suffered to escape. In determining the ground plan, these trunks are to be located in the most eligible situation, and at the required distance from each other for the moveable section to be alternately connected with either, as occasion shall require.

Any inconvenience that might otherwise occur in consequence of the air chest and moveable section deviating from their perpendicular situation may be obviated by means of four suitable iron, or other projections, being made fast to the corners of the former, and four others to the corners of the latter, at right angles respectively with their sides, having notches provided in their outward ends, that shall be adapted to slide upon four iron or other guides, attached, in the required position, to upright posts of wood, extending from the bottom of the well, to the top of the Lift. Any premature ascent or descent of the air chest, and moveable section, after they shall have attained their highest or lowest position, may also be prevented by the application of such clicks, springs or other appropriate fastenings as may be deemed the most convenient for that purpose.—And in the event of the air chest being so constructed as to be liable to admit a small portion of leakage, a suitable cavity may be provided in the bottom, into which the water shall, from time to time, be collected to

such a depth, that by means of a pump, it can readily be so far exhausted, that the residue shall not be productive of any material disadvantage.

The magnitude of the air chest must be adapted to the heaviest tonnage that may reasonably be expected to be the subject of its operation. Should it be concluded, for example, that it would not be necessary to provide for a greater weight than 30 tons, an experimental calculation might be thus assumed; It is understood, that the weight of a cubic foot of water is about 62 1-2 pounds; but to make a competent allowance for leakage, in case it should occur, let only 56 pounds, that is half a hundred, be estimated as the weight of that proportion of a cubic foot that may, in this instance, with certainty be applied. Agreeably to these premises, the number of cubic feet in the capacity of the air chest would require to be equal to the number of half hundreds in 30 tons; that is 1200; admit then that 50 feet long 8 wide, and 3 deep, were assumed for the dimensions in question; 8 times 50 are 400; and 3 times 400 are 1200 cubic feet, which exactly corresponds with the number of half hundreds in the tonnage proposed. Had the weight of 40 tons been assumed, instead of 30, the depth of 4 instead of 3 feet, would have been the rusult, admitting the 50 feet long and 8 wide to have remained the same.

To the size of the air chest, both the size of the well and the size of the moveable section will require to be adapted. It is evident that the length and breadth necessary for the latter, must be sufficient for it to receive the boats or whatever else was intended to pass through it. Its depth must be so adjusted, that it may contain a quantity of water sufficient to form an equilibrium with the air chest; or even to preponderate, and cause both to descend to their lowest situation. In determining the size of the well, it will be necessary that its inside dimensions shall so far exceed the outside dimensions of the air chest, that the space between them shall be sufficient to admit the water to flow freely through it; otherwise, in the event of the intermediate space, in this respect, being too limited, the ascent and descent of the boats and their cargoes, must necessarily be retarded in proportion, and may possibly be rendered so slow as to occasion great detention. The proper allowance, however, will require to be determined be actual experiment, at least upon a small scale. Until this shall be done, perhaps the distance of eighteen inches or two feet all round would be deserving of a trial.

Under a due consideration of the foregoing premises, it must be conclusively evident that the natural tendency of the air chest will be, to continue to float, either partly above, or at least at the surface of the water, as long as the quantity of the fluid which it displaces shall be specifically heavier than the weight of its own pressure, into the water, added to the weight of its incumbent appendages. But let a preponderating portion of weight only be added to the said incumbent weight, so that the displaced quantity of the fluid shall be specifically lighter than the pressure of the said weight into the water, and it will then follow with equal certainty that the air chest will necessarily descend, together with the moveable section, to their lowest situation. And because the said descent was produced merely by a preponderating weight being added for the very purpose of producing that effect; it can only be necesrary to take away the preponderating weight so added, to cause the air chest immediately to reascend with the moveable section, by which means they will both regain their former situation.

Thus, it appears that the air chest and moveable section may be made to descend and ascend, the former in the well and the latter between the upper and lower trunks, at pleasure, merely by a small preponderating addition to, or deduction from the weight incumbent upon the air chest; after the original weight shall have been previously adjusted to the capacity of the said chest. Hence, the following may be adopted as

The manner of operation.

Admit the moveable section to have been elevated to its upper situation, and the safety fastenings to have been applied; also, the quantity of water to have been adjusted to the capacity of the air chest and the moveable section, to have been connected with the upper trunk. Then, in the event of there being a descending boat in the upper level—let the two gates leading into the moveable section be opened, and the boat propelled forward into the said section.—As the boat advances, whether it be empty or loaded, or the cargo heavy or light, an equal weight of water, pound for pound, will be displaced, and caused to flow backward, out of the moveable section, through the open gates into the upper canal or level of the route; then shut the said gates, and after the fastenings of the moveable section shall be made loose, let the boatmen step on board. They will thus be a preponderating weight, which, in the event of its being sufficient, will immediately cause the air chest to descend in the well, to its lowest situation, by which means the moveable section will be brought to coincide with the lower trunk, where it is to be secured with the safety fastenings, and connected with the said lower trunk.

Then, if the gates leading out of one end of the moveable section be opened, and the boat propelled forward; as it advances into the lower level, an equal weight of water will be displaced there, and made to flow back into the moveable section; provided it shall be prevented from running ahead by introducing a gate a little forward from the boat, in the lower level; so that now the original weight of water, probably with the loss of a little leakage, will be restored into the moveable section; and the descending boat will also be placed in the required situation, ready to pursue its appointed route.

In the mean time, should an ascending boat be present—immedietely after the descending boat has been propelled out of the moveable section let the ascending boat be propelled into it; by which means an equal weight of water will be displaced, out of the said section, and caused to flow downward, through the open gates into the lower level. When the gates shall now be shut, let care be taken to cause the ascending boatmen to be on board, so that their weight of water may also be expelled downward and shut out, together with that of the boat and its cargo. The moveable section is then to be detached from the lower trunk, and after the boatmen shall have stepped off upon the bank, by the time they shall have reached the top of the Lift, by means of a ladder or otherwise, the air chest and its appendages including the boat and its cargo, if any, will have attained, or at least be steadily pursuing their ascent to their upper situation. It will then only remain to secure the safety fastenings, to connect the moveable section with the upper trunk, to open the gates, and propel the boat forward in pursuit of its destination.

In case of there being one or more ascending or descending boats and no boat pursuing the opposite direction, as no water would be displaced, the weight of the boat that was wanting would, at every operation, be supplied by the water that was not removed out, remaining in the moveable section. Should any difficulty occur in such cases on account of there being no boatmen to step off or on, as a preponderating weight, the deficiency may be easily supplied by letting a sufficient quantity of water into or out of the moveable section, for that purpose; or whenever there should be a redundancy of water in the air chest, it would be preferable to pump out the required portion from thence, instead of letting other water escape. Or should it be desirable, on any other account, to vary the operation, a crane and weight; a block and pulley; two or more racks and pinions, or some other mechanical apparatus may be adapted.

Where the declivity shall prove so great as to require two or more lifts to be constructed near to each other, particular care should be taken to arrange their several positions to the

best advantage; and more especially in such a manner that between every two lifts there may be an intermediate section of canal, sufficiently long, wide and deep to receive at least one ascending and one descending boat at the same time, and to let them pass each other with facility, otherwise a series of interruptions and delays that ought to be avoided would be certain to follow.

Having given a distinct explanation of the manner of ascending one lift, it is evident that to "float a boat over any summit-level, with its cargo on board," as before stated, it will only be necessary to repeat the same operation, time after time, as often as shall be required to reach the top of the last and highest elevation, and after having passed across, to its other extremity to descend lift after lift, according to the manner of descent before described, to the lowest and last level at the bottom of the high ground over which a water conveyance may, in this manner, with facility, be accomplished.

Besides the immense saving of water that appears to be perfectly practicable in pursuance of this plan, the advantages, to canal companies, in other respects are of the utmost importance. The situation of the proposed rectangular well is such that it will be entirely convenient for it to be substantially embanked around to any extent that may be desirable.—Hence its position will be extremely favourable for securing it, in the most effectual manner, against the injuries of intense frost. Hence too, instead of a great abundance of stone work of the most difficult and costly description, even of hewn stone, as is required in locks of the usual construction, clamped and bound together in the most sustantial manner, and at a very heavy expense, amounting, according to situations and circumstances, from eight to ten or twelve hundred dollars for every foot lift, it is presumed that good quarry stone, faithfully put together in a strong and durable manner, would, in the walls of a well, be amply sufficient to answer every necessary purpose. It has, in fact, been estimated that at least one third, or probably one half of the money that is usually expended in the construction of stone locks might with convenience be saved.—Another circumstance highly favourable to the adoption of the improvement under consideration is its vast superiority in point of expedition when compared with that of common locks. Wherever there should be such a declivity upon the route as to require a number of these locks in succession, no boat could ascend while others should continue to descend;—neither could any descend until others had ceased to ascend; whereas, according to the said improvement, their alternate ascent and descent would be perfectly convenient, and preferable in every respect. Thus, there would be a double portion of business accomplished in the same time, and with equal facility, admitting the supply of water for the locks was so abundant as never to occasion the least detention.

Again, the savings that may rationally be anticipated in relation to the purchase of water power, and mill property, would in many instances be immense. The quantity of water required to fill large locks, more especially for an extensive trade, according to the usual method of locking up and locking down, is so enormous, that nearly the whole of a common mill stream would be necessary, or, however, to such an extent, that upon some routes many valuable establishments would be literally ruined, and many more very materially injured. Under these circumstances the different mill owners, to a man, would be certain to be upon the alert, in swelling their respective charges for damages to the utmost amount possible; whereas, in consequence of the very reduced quantity of water to which the real necessity of the case may now be limited not exceeding a supply of a very few square inches at most, it would rarely if ever be felt by the millers, and would, at the same time, be abundantly sufficient for the purpose. From the incalculable advantages that all such property holders would be certain to derive in consequence of their having a water

conveyance, immediately from their mills to market, the value of their property would be very much enhanced Every individual amongst them would be deeply interested in promoting the route of the proposed canal being located as near to them as possible They would be deeply interested, not only in furnishing the few square inches of water that would be required, entirely free of expense, but also in making a generous surrender of the land and materials that would be wanting, and becoming liberal subscribers for the stock that would be necessary for carrying promptly into effect an object of the most general and extensive utility. An object, that in addition to the certain and rich harvest, both of profit and honour, which it is capable of securing to the original undertakers, must, from its very nature, be increasingly beneficial to millions after millions of inhabitants, through successive ages of future posterity.

[Messrs Roland & Pickering took out a patent in 1794 for a Lock very similar to Mr. Kenworthy's. (See Repository of Arts, &c. vol. I. p. 81.) It was carried into execution on the Ellesmere canal, near Raubon, in Derbyshire, and answered very well.

This plan is simple and ingenious; and, no doubt, in the hands of a skilful engineer, would answer a highly valuable purpose in many situations in our country.

The surface of the water in the well, however, should be somewhat lower than that in the lower canal, in order to make that in the transit lock correspond to the same level.

The same precautions would then become necessary in passing the boat from the lock, after its descent, as are observed in passing the boat into the lock before its descent. This arrangement becomes necessary in consequence of the equilibrium that takes place between the sinking and buoyant materials, when its bottom part has only arrived at the surface of the water in the well.—Ed.]

BENFIT SOCIETIES.

The principle upon which Benefit Societies are founded is that of mutual insurance, which may be thus illustrated:—A number of men agree to pay a certain sum per month towards a fund, from which we wil suppose they are to receive, when afflicted by sickness or accident, a given amount per week; every man has an even chance of being sick, if the ages be equal; and if the sum paid to the fund be adequate to the average claims, such an institution will, without inconvenience to any of the members, provide a regular income for all such as may fall sick until the whole of them die off. If an additional payment towards the fund be made for that purpose, every member's surviving friends or family may, on his death, be entitled, to a given sum, to provide for the necessary expenses which too often add to the afflictions of the survivors. But the calculations for these provisions are dependent on many contingencies, and can only be made by experienced persons For instance suppose that on a reference to the sickness in a population, it should be found that the average yearly number of sick is two in a hundred. any common arithmetician would naturally conclude, that the payments of one hundred members ought to amount to the annual sum which will support them, and that then the society would be safe. But this is erroneous; for although the average out of many thousands is two to the hundred, yet it will be found that were all to be formed into clubs of one hundred each, some clubs would average three or four in their hundred sick, while others would have scarcely any; whereas, had half a dozen of these societies been comprised into one, the average would be nearer.

With these facts before us, we propose to offer a few general observations, which we trust will facilitate a speedy reformation in such societies as may require it and inspire additional confidence in those which are really beneficial.

There are, therefore, two errors to be avoided:—First, more money must be demanded than is sufficient to meet the common average:—and, secondly, the societies ought to contain as many members as possible.

Again—although the average upon

all ages mixed may be two in the hundred it would be found that of those at twenty five years of age it may be only one; of those at forty-five it may be two; of those at sixty it may be three; therefore, although the proper average in the whole life may be two, that calculation must only be taken for young men, who will receive very little for some years, and be paying a surplus to meet their increased claims when they become old; consequently, older men must not be admitted; or, if they be admitted, they must pay higher for their increased risk. It appears, then, that to secure the safety of a Benefit Society, the payments of the members must be ample, and indeed ought to create a surplus; that no members ought to be admitted above a certain age without paying accordingly; that the society should be conducted by an experienced person; that the number of members should be unlimited; and that a fund be provided extra for its expenses of management. There are, however, other absolutely necessary points to be considered; the committee should have ample powers, and be elected by the members from among themselves; and that a meeting of the members should be held at least annually to elect the said committee or a part of them, and to control the general affairs of the society. If one of these points be neglected, there is danger; and if the whole be attended to under plain and simple regulations security and permanence cannot be disturbed.

There are many more considerations to urge, perhaps, if we were proposing a plan. But it was societies like this which were contemplated when the Committee of the House of Commons were convinced of their efficacy; and it is not too much to say, that had such been established in every large district, millions of money that have been furnished and expended under the poor laws would have been cheerfully provided by the very thousands who have become paupers and vagrants, and eventually criminals; the first, perhaps, by sickness; the second, through the facility with which their wants were supplied; and the last from natural degredation, which ever follows beggarly dependence.

Lond. Mec. Jour.

CURING DAMP IN ROOMS.

GENTLEMEN:—Observing in your late Numbers two receipts for the prevention of Damp in Rooms, in one of which thin lead is recommended to be put on with small copper nails, before papering, I beg to mention that many rooms in this neighbourhood have been done in this manner, and cured most effectually of the damp. There is a rolling-mill at Pateley-bridge, in this county, where a very superior article for this purpose is manufactured, and where it may be had at any time. I believe the quantity required does not exceed more than 2 1-2oz. to 3oz. per square foot.

J. W.

Lond. Mec. Mag.

AN ARAB'S FORGE.

An Arab's forge is simple, and almost every man is his own blacksmith. A small mud or clay wall is built to the height of a foot or eighteen inches, a hole is then made even with the ground, and an iron pipe introduced. To this are attached two skins, which open at the upper end by two sticks having a small leather handle on each; the thumb is passed through one of these, and the fingers through the other, so that the hand easily opens and shuts the skin. The mouth being closed, the skin is pressed down and throws a strong blast through the pipe. It is again opened and lifted up, when it is once more ready; thus alternately with each hand the current of air is kept up to the fire which lies over the pipe. Camel's dung is used when charcoal cannot be procured, and gives a very strong heat. The anvil is a small square-ended piece of iron, which is sunk in a log of wood, and partly buried in the sand. An ordinary hammer and a pair of pinchers complete the apparatus.

Lond. Mec. Jour.

PLAN OF A WATER CLOCK.

SIR,—A Correspondent proposes a plan for a clock without wheels; it is ingenious, but I think while he retains the cylinders, he will have gone but little way towards the accomplishment of his design; for though they may not be wheels by name, still their principle being the same, there are many who will call them so in effect; and a clock, to be properly without wheels, ought to have no part of it moving in a circular direction.—Believing it to be possible to construct such a clock, I will, with your permission, lay the means before you.

Description.

b is a vessel, open at the top, containing water.

a is another vessel, similar to *b*, but smaller in diameter, and of sufficient weight to sink; this vessel has, in the bottom, a small hole that will but just allow the water to pass.

c is a wire fixed in the centre of *a*, as shown by the dotted line.

d is a scale divided into hours, and numbered twice 12.

e is a glass tube, let half way into the scale, about half an inch in diameter, in which the upper part of the wire moves; the wire has a small flanch on the top.

To set the clock going, the vessel *b* must be filled with water, when *a*, being empty, will of course be lifted into the position shown in the sketch.

The diameter of this vessel may be regulated so as to allow a fall of nine or ten inches in the twenty four hours; the fall (if the idea I have formed be correct) will become more rapid as it descends; but if it can be regulated so as to fall about three-eighths of an inch in an hour, a nonius or vernier may be applied on the top of the wire, and may be divided to show the time to a single minute; whereas, unless the scale be very long, it will not do it to less than ten or eleven minutes, without crowding the scale.

I am, sir,
Your obedient servant,
O'PINION.

February 23, 1825.

Lond. Mec. Mag.

EXPEDITIOUS WORKMANSHIP.

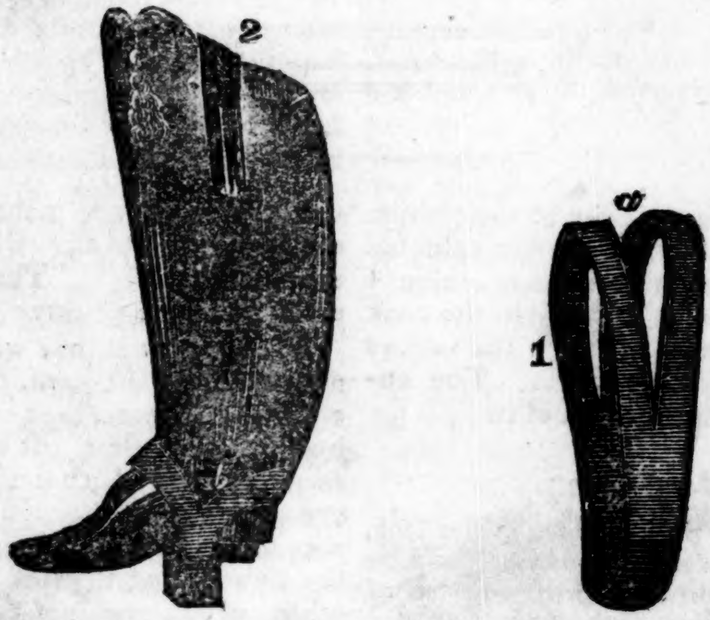
A mechanic, in the employment of Mr. Simon Hamer, contractor for the new canal at Knottingley, has under-

taken, for the small wager of five guineas, to complete a cart wheel in five hours in a workmanlike manner; the nave to be ready turned and hooped, the felloes and spokes to be from the axe and saw, the wheel to be not less than four feet four inches in diameter, and its strength in proportion to its size. This work is to be done in his own shop, near the house of Mr. Mark Hepworth, the Dog Inn, in Knottingley, on Monday, the 13th instant.

Lond. Mec. Reg.

A CHEAP, INFALLIBLE, AND PORTABLE BOOT-JACK.

From the London Mechanics' Register.



Description.

Fig. 1. consists of a piece of tough leather, about eighteen inches long and an inch and a half wide, the ends of which are to be firmly sewn together with wax end, having an incision cut as represented at *a*, the opening of which must be sufficiently large to admit of the foot of the boot to be pulled off passing through, as shown at *b*, in Fig. 2, one part resting on the instep, the other on the heel; the toe of the other foot is then to be thrust into the vacancy at *c*, when, by a little exertion, the tightest boot may be drawn from the leg with the greatest certainty. A boot jack of this description is cheap, because it cannot cost more than one shilling; portable, because it may be conveniently carried in the coat pocket, or rolled up into a very small compass; and infallible, because it has an equal purchase on the instep and heel, without the possibility of the boot slipping out.

S. HOLLANDS.

Southville. *ib.*

NEW METAL.

A new metallic composition has lately been invented by Dr. Geitner, an able chemist in Saxony, the properties of which closely resemble those of silver. It is malleable, is not subject to rust, and is not liable to become tarnished. This composition has already been made use of in the manufacture of candlesticks, spurs, &c. and will in all probability (according to some of the foreign scientific journals) be converted into a substitute for plated goods.

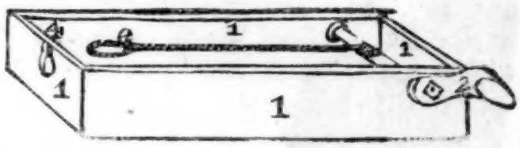
ib.

REMOVING ATMOSPHERIC PRESSURE.

A Correspondent mentions that he had raised water to the height of eight inches, in a funnel, by the blast of a pair of bellows directed over the mouth of it. A writer in Dr Brewster's Journal of Science (No IV for April, page 243) states, that profiting by what he had thus read in the Mechanics' Magazine, he has "since found the principle of much service in the use of a syphon, for, by directing a blast from the mouth, through a tube rather larger than the syphon, in a direction nearly parallel with the leg, the liquid is raised over the bend, and thus begins to flow without the inconvenient process of filling it, as is usual."

Lond. Mec. Mag.

MACHINE FOR UNSINEWING TURKEYS.



SIR,—I beg to offer to the public, through the medium of your valuable publication, the plan of a machine I have lately made by which the cook can, with ease, extract the sinews from the legs of turkeys. The annexed is a rough sketch of it.

Description.

I, I, I, I, is a trunk, fifteen inches long, three inches wide, and two inches deep.

2, a small winch, to which is attached the cord, 3, which, having a noose at the end, is fastened to the leg of the turkey, which, having been previously broken, is laid in the hole, 4; by turning the winch the sinews will be drawn out.

I am, sir,
Your humble servant, G F.

ib.

ON SHOEMAKERS' AWLS.

This may appear but a trifling article; but, if we consider the number of them that are used, the greatness of the number will compensate for the individual smallness

Shoemakers' awls are pointed instruments used to pierce a triangular hole in leather, for the purpose of sewing two pieces of it together; besides shoemakers, many other working tradesmen occasionally use these instruments. Some are straight; but the generality are more or less curved, according to the work for which they are intended They are fastened in a handle of turned wood.

The first awls that were made had not their present form, but were plain conical punches, that made a round hole in the leather. It was, however, soon discovered that this form was erroneous, for the hole thus made was never more than half filled with the two waxed threads crossing each other, which are used to sew leather. Indeed the section of the two threads might be regarded as two circles, which touched one another, and were inclosed in a third circle, which touched both the others at the opposite extremities of their diameter;—now, geometry teaches us that those two small circles are only half the surface of that of the larger inclosing circle.

The conical awl was then flattened, and had an oval form as to its section given it; and some time afterwards the awl was filed so as to give it four faces, the section being a lozenge with cutting edges; but still the awl was straight. Although this straightness is useful in many cases, yet it was improper in the business of shoemaking, as may easily be conceived.

Suppose it were wished to sew together, quite close to the edge, two

pieces of leather placed one upon the other, and that a straight awl is used, the hole that it will make will constantly push out the leather towards the edge, and give it a convex form; and when the sewing is done the edge will exhibit a row of festoons, which it will be necessary to rub down by means of a knife, in order to give a regular edge to the pieces, but which by this means will lose much of its strength. Now, if, on the contrary, a crooked awl is used, and pushed in properly, it may be brought very near the edge by making it describe the arc of a circle, whose convexity is opposite to the edge; by this simple means, the festooned appearance of the edge produced by the straight awl will not be formed, and of course the strength of the leather will be preserved undiminished, and the sewing itself will be strong. Unfortunately the name of the person who conceived the happy idea of bending the awl is lost.

It would be very advantageous if all awls had exactly the same degree of bend, which might easily be given; but unhappily, every maker gives his awl a peculiar bend, to the great trouble of shoemakers and the other artists who work in leather. However little we reflect upon the manner in which the hole ought to be made in the two pieces of leather, which are placed one upon the other, we shall be convinced that the awl should come out of the lower piece at the same distance from the edge that the workman put it into the upper piece. This can only be done by that sleight of hand which long practice gives; and when this sleight of hand is once acquired the workman can do it with ease, without paying any particular attention, as long as he uses the same tool: but when this is broken or mislaid, the workman is sometime before he can acquire the same sleight of hand with a new tool. It is upon this account that a shoemaker is always sorry when he breaks his awl; because he knows very well that he shall be obliged to serve an apprenticeship of several days before he can acquire the necessary sleight of hand with the new tool. If the new awl is more bent than the old one, it will come out nearer the edge than it entered, because its point will describe an arc of a less circle; on the other hand, if the new awl is less bent than the old awl, the point will come out at a greater distance from the edge, and the work will have a still worse appearance. Hence the workman is obliged to make a series of trials, until he can attain the necessary sleight of hand for this purpose.

Awls are made by forging, and filing; the best are made of steel, but the generality are made of iron, and then case hardened.

The workman takes a small bar of steel, drawn out beforehand into a rod nearly the size of the awl that is to be made; the part that is to go into the handle is forged first, and then the awl is placed upon a groove cut in a matrix placed upon the anvil, and a punch having a similar groove is placed upon it, and by three or four blows the awl acquires the proper form. It is then filed to sharpen the edges, then bent, and afterwards tempered and polished.

The French awl makers bend them by placing them on a block of lead, and striking them with a wooden mallet; and hence they seldom produce the same degree of bend. The English awl-makers place their awls upon a groove cut in a small steel anvil, whose face is curved equal to the bend intended to be given to the awls; and by striking them with a wooden mallet until they have taken the exact bend of their anvil, they produce by this means awls which have the peculiar bend of that manufactory; it were only to be wished that all the manufacturers would agree to adopt the same degree of bend.

After the awl is tempered, the English examine them afresh, to be assured that the bend is not altered; or, in case that this has happened, to restore the bend by striking them with a mallet on the anvil.

Awls are polished differently from needles; for in needles the polishing is made across them, but in awls it takes place lengthways. The awls are put into leather bags with emery

and oil; and the two ends of the bags being raised alternately, either by human labour or a mill, the friction of the awls against one another polishes them in a very short time. As awls are not required to be so finely polished as needles, emery, with oil, is first used, and then common tripoli.

Lond. Mec. Jour.

ON TRACING DESIGNS FOR EMBROIDERY.

A very important part of the art of embroidery, and which is of great consequence in regard to preserving the taste of the original design is the manner of tracing the design on the cloth or other substance. The draughtsman must pay the greatest attention to it; and he ought always to pick out the design with a needle. Considering the importance of this being properly done, it ought not to be trusted to any one who does not draw well, and is not very careful; for if too much haste is made, the original outlines may be easily altered.

It is well known that the usual method is to transport the design from the paper to the stuff, by means of a small bag of charcoal powder. The lines of the drawing are pricked with a needle, and the charcoal powder passes through these holes, and is deposited upon the stuff. A pen is then used with either black or white ink, according to the colour of the stuff, to trace over all the dotted lines made by the charcoal powder that has passed through the needle holes. It is necessary, as has been stated above, that the artist who does this should draw well, and posses no little address, lest he should alter the design; and yet frequently before the design is finished, the traces of the charcoal powder get rubbed off, which occasions a great deal of trouble.

An ingenious method has been lately used by some embroiderers to remedy this inconvenience, and to avoid the trouble of tracing the design over again with a pen, which is not only a loss of time, but it is also attended with the hazard of alteration: whereas M M. Revol and Regondet's method preserves the original design in its purity and taste, and allows the embroideresses to give greater perfection to their work, without any fear of rubbing it out.

The composition they make use of is prepared by melting some mastic in an earthen pot, with about a thirtieth part of wax, oil, or tar, to which is added a little lamp-black, and the whole is well stirred together with an iron spatula. The whole being well melted together, it is poured out into little paper boxes. When cold, the mass is to be powdered and sifted as fine as possible. The design, then, being pricked, is dusted with this powder, let the matter be what it will; and this being done, the powder is fixed upon the stuff, by passing it over a chafing dish of lighted charcoal, so as to melt the powder; or by putting a paper on the stuff, and running a hot iron over the paper.

If the stuff is of a black or very dark colour, a white powder is desirable; and this is made by melting, as before mastic in an earthen pot, over a gentle fire, adding a thirtieth part of white wax, and as much whiting as the mastic and wax will take up, taking care to stir it as the whitening is added. The mass being poured out, cooled, and powdered, is used as the former black powder.

HISTORY OF SOME LATELY EXECUTED FRENCH STATUES IN BRONZE.

The art of casting in bronze is an art in which it is generally apprehended that the ancients were superior to the moderns, although some fine statues have been cast in modern times.

If we may judge from the following histories of some statues erected within these few years in France, we must be allowed to think that in this respect they are very inferior to our own founders.

It should be well known that the composition of the bronze influences its properties very much, insomuch, that the same results will always be obtained from it, if it be composed of similar proportions of ingredients, and

the casting conducted in the same manner and with the same care.

Upon this account, the brothers Keller, who cast many very fine bronze monuments during the reign of Lewis XIV., paid the greatest attention to the proper composition of the bronze; but at the present day less importance is attached to this part, which is the more surprising, because the late experiments in chemistry have shown several improvements that might be made in this part of the business.

The execution of the bronze statue to the memory of General Dessaix, was put up to contract to the lowest bidder. A contractor undertook to execute it for 100,000 francs, or £4166, exclusive of the bronze, which was to be found him. He gave up his bargain to a bell-founder, who having had no experience in so large a work, and forming his calculations upon the small castings to which he had been accustomed, undertook to do all the work for 20,000 francs, or £833, under a considerable forfeiture but in order to secure himself from every possible extra expense, he bargained that the sculptor should not superintend the formation of the moulds. The more difficult hollow parts were filled up, in order to get rid of the difficulty of moulding them. The moulding was done in sand, in frames. The furnaces were built, a scaffolding was erected, and at last, after much useless expense, the casting was begun. The frames gave way with the weight of metal, and the bronze run upon the ground, so that the casting completely failed; a large quantity of bronze was lost and they were obliged to begin again.

In this second trial, the bell-founder thought he should succeed better by casting the statue in separate parts, but he did not ascertain the exact composition of the various parcels of bronze, did not calçulate the contraction they would suffer, and thus his parts did not fit each other properly. However he joined them together, although all the proportions of the figure were altered; and as these defects could not be altered by the chisel of the sculptor, the whole monument was utterly spoilt.

Another monument was erected in the Place Vendôme, formed of the cannon taken at the battle of Austerlitz This column is 75 metres, or 246 feet high, including a statue of Bonaparte, which stood at its top, of 3 metres 35, or 11 feet in height. The weight of the metal being 90 ,000 kilogrammes, or 1,985,706 lb. avoirdupois In the erection of the column the same faults were repeated. A bargain was made with an iron-founder, who had never either moulded or cast in bronze. He had however, the presumption to undertake the moulding, and even chiseling of this column, at the rate of a franc per kilogramme, or about fourpence half penny per pound. The French government, on their part, engaged to furnish him with cannon, which had been taken from the Russians and Austrians, in the campaign of 1805, to the weight that should be required, allowing him 10 per cent for the loss of metal in casting; an allowance which appeared to him so large, and so far exceeding what he expected would actually take place, that he even sold some of the bronze delivered to him, before he commenced the casting.

M. Darcet, foreseeing that the government would not succeed in erecting a monument worthy of the nation in thus leaving every thing to the conduct of a man who had not either sufficient theory or practice for this task, advised the director of the work to keep an account, by means of assays, of the composition of the various parcels of bronze furnished to the contractor, and thus to establish a responsibility as to the weight of the several metals of which it was composed, between the government and the contractor; by which also they would have the advantage of showing the founder the proportion of the different kinds of metal delivered to him and thus to render it easy for him to make his mixtures, so that the column should be formed throughout of one uniform metal.

The director not comprehending

the importance of this advice, refused to follow it, and all the cannons were delivered by weight alone, The founder, to whom notice of this responsibility in receiving the bronze upon assay had been given at first did not imagine that this regularity was necessary for his own security, and perhaps even thought that it was more for his interest to let the matter remain undecided, said, that he ought not to be wiser than the government. He did not dream that the government would be too strong for him.

M. Darcet also thought, that by making experiments to perfect the method of moulding, the pieces might be cast very sharp and not requiring much finishing by the chisel; so that the separate parts would be perfectly similar to the model, and that the able sculptors who finished them would not hesitate to add their names, so that the monument would be in every respect worthy of the age.

No notice was taken of this advice; and the iron-founder built, at a considerable expense, a foundery on purpose, instead of making use of the large workshops possessed by the corporation of Paris, which had been erected for casting the statue of Lewis XV. He used a furnace, such as is constructed for melting iron; but not understanding the appearance presented by bronze when melted, and wishing, out of vanity, to cast the large pieces of the base of the column first, he failed in several castings; and by thus being obliged to cast his metal several times over, he altered the bronze by oxidizing and separating the tin, lead, and zinc, and leaving the copper more and more pure The oxides of the separated tin, lead and zinc, were lost in the slags and dross. He did not perceive this loss of his metal, and went on blindly delivering his castings, of different degrees of purity, but all containing more copper than usual in bronze.

When two thirds of the column were finished, the iron-founder had cast all his metal, and to make up for his loss, he tried to finish his work by reducing the slags and dross of his former operations, and mixing with it a large proportion of old metal of all kinds, which he could buy at a low price. The castings thus produced were honey-combed and spotted their colour, originally a dirty grey, speedily turned black; and these castings being refused by the architect, the works were stopped, and the effects of the founder seized by the government, until his conduct could be investigated

He demanded and obtained a board of inquiry, formed of two chemists, two architects, two mechanics, and two founders, presided by a member of the treasury. This board asked for the assays of the metal delivered to him; but this had, as stated above been neglected. Their only recourse was to assay the pieces delivered by him, and the remainder of the cannons which had not been delivered to him

By cutting off pieces of each casting, of a weight proportional to that of the casting, and melting them together, they formed an ingot, which showed the average composition of the whole column; and this they found to be copper 89.44 per cent; tin 7 2, lead, 3.313; silver, zinc, and iron, 0.047. The cannons remaining in store being assayed in the same manner, gave copper, 89,36 per cent; tin, 10.04, lead, 0 102; silver, zinc, iron and loss, 0 498.

From the assays, the board of inquiry decided that the iron-founder had not been guilty of any fraud, as the average of the metal was nearly the same as had been delivered to him, although the different parts of the column were very different in their composition. The bas-reliefs of the pedestal contained only 6 per cent of other metals united with the copper; this alloy, however, went on increasing as the work proceeded, so that the upper part contained no less than 21 per cent. of other metals united with the copper. Hence it is evident that his ignorance in the business made him cast his first deliveries above the proper alloy, and then he was forced to use inferior metal for

the latter deliveries. The man, however, although acquitted of fraud was ruined by the contract.

The moulding was done so badly, that the sculptor who finished them struck off no less than 70,000 kilogrammes, or 154,443lbs. avoirdupois, of the metal, which were given up to him, besides his charge of 300,000 francs, or 12,500*l.*

By a kind of fatality it was forgotten to calculate the effect of the heat of the sun in dilating the metal. All the pieces of which the pedestal consists surround a solid cylindrical core of masonry, and are strongly fastened together by cramps at a short distance from each other. The sun's rays shining powerfully on the column at times, expands it on one side only, and again in summer evenings after being strongly heated it cools suddenly; at both these times loud cracks are heard, and the column has split in several places. Bonaparte himself had proposed a mode of construction that would have prevented this inconvenience. His plan was to form the column of hollow cylinders, each of the necessary height for the basso-reliovos to be sculptured upon them, and placed one on the other by means of mortises and tenons, sufficiently loose to allow of the effect of the dilating the column might suffer from difference of temperature.

These unfortunate results were entirely owing to the statues being put under a wrong direction. Had the casting of them been entrusted to the officers of the mint, who are accustomed to the management of metals, these errors would certainly not have happened, as will appear by the following fact:—

At the same time that the government entrusted the erection of the column in the Place Vendome, to such incompetent hands, they also wished to re cast all the main bodies or frames of the screw presses in the mint, out of the twelve hundred cannon that had been taken from the allied forces during the campaign of 1805. Cannons were sent to the mint, and here was neither routine of business nor wrongheadedness to overcome. The cannon were assayed separately, an average was struck and measures were taken to make each casting of the same composition. The melters of the mint succeeded at once, the pieces were all of similar composition, although of considerable size and weight; as the frame or main body of the screw presses for coining gold pieces of 20 or 40 francs, or 16*s.* 6*d.* and 33*s.* or silver pieces of 1 and 2 francs, or 10*d* and 20*d.* weigh 1713 kilogrammes, or 3774lbs. avoirdupois. They were all of the same colour, of a very fine grain, and their surface was smooth and metallic; so that this monument of that campaign is far superior to the other.

It does not appear that the Bourbon government is more happy in their attempts to erect bronze monuments.

Lond. Mec. Jour.

EXAMINATION OF PALLADIUM.

Mr. Breant, having had placed at his disposal all the platina in the possession of the Spanish government, being no less than twenty hundred weight, obtained from it a quantity of palladium, which enabled him to examine its properties on a large scale.

From his examination we make the following extracts:—

Palladium has the colour of silver, and is equally workable; it is twelve times as heavy as water bulk for bulk, and, of course, about one sixth part heavier than silver itself. It is melted with great difficulty, and requires as great a heat as iron. It is not subject either to tarnish in the air, or rust by moisture. At a dull red heat it takes a reddish violet tinge; but at a greater heat it again acquires its shining metallic appearance.

This metal dissolves in a mixture of aquafortis and spirit of salt, without the necessity of heating the liquid. It unites easily with other me-

tals, and the alloys are generally workable.

Gold united with it, even in very small quantity, entirely loses its yellow co our.

From these qualities, it appears, that if this metal was more common, it wou d be preferable, for certain purposes, to silver; but, unfortunately, it is at present so rare as to be six times the value of gold.

ib.

MEASURE OF FORCE FOR PERFORATING METAL AND OTHER SUBSTANCES.

Sir,—The measure of the force necessary to punch a hole through a plate of metal or other sub stance may, perhaps be interesting to some of your readers. I shall, therefore, trouble you with the result of some experiments made on that subject.

I had a good cylindrical steel punch made, and fitted to a guide or director, so as to move correctly to a cylindrical hole in a steel plate connected with the guide; with this instrument I was able to force cylinders of metal very uniform, and with little or no bur to the hole, both by simple pressure and by percussion.

The results of some experiments made on the force of simple pressure, to make a hole through a metal plate of one-eighth of an inch in thickness, and one-fourth of an inch in diameter, are as follows:—

Substances	Pounds
Plate iron	3900
Cast brass	3200
Hammered brass	3600
Copper	2800

The following are the results from wood, in the direction of the grain, of the same machine, on specimens of the same thickness and diameter:—

Substances	Pounds
Christiana deal	135
Mahogany	170
Dry box wood	356
Beech	204
Ash	197
Oak	156
Elm	122

I am, sir, your most obedient humble servant,

B. Bevan.

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